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zoön, furnished by Dr. Dawson of Montreal, with one from the Devil's Den, fully established the discovery. In a letter from Mr. Bicknell which we have seen, he says — "I have no hesitation in saying, if the Canadian specimen is Eozoön, the Newburyport one is also." — H. C. PERKINS.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

Prof. A. E. VERRILL read a paper "On the comparison of the Coral Faunæ of the Atlantic and Pacific Coasts of the Isthmus of Darien, as bearing on the supposed former connection between the two Oceans. The question of a former connection between the Atlantic and Pacific, across the Isthmus of Darien, has very important bearings both in Zoölogy and Geology. With many geologists it has been a favorite and convenient theory to account for climatic changes in Europe by a depression of the Isthmus sufficient to allow the Gulf Stream to flow into the Pacific. Admitting a connection it does not necessarily follow that the Gulf Stream would flow into the Pacific, for a current in the opposite direction might result, while with a shallow channel, owing to the difference in the tides (twenty-two feet at Panama and about two at Aspinwall) it is probable that the flow would be first one way and then the other. The evidence from Geology is quite insufficient to establish the theory, and the facts cited have in most cases proved unreliable. The zoölogical evidence is mainly the occurrence of identical and closely allied species on both sides. Thus of mollusca about fifteen hundred species occur upon the west tropical coast, of which Dr. P. P. Carpenter enumerates thirty-five species as identical upon the two coasts; thirty-four as doubtful, but possibly identical; and sixty-seven that are closely allied, but evidently distinct. Since his lists were published other species have been added to them, among which *Paphrydia bullata*, a common West Indian shell, which has recently been received with *Codakia tigerina* from the Gulf of California, by the Museum of Yale College. Dr. Stimpson admits eight or ten species of Crustacea as identical, and although Mr. Ordway has separated the *Callinectes* of the west coast satisfactorily, there are other identical species among the large collections recently received from that coast by the Museum of Yale College, through Mr. Bradley and others, so that of about 150 species of Decapods, ten or twelve appear to be perfectly identical, not showing even varietal differences. Among 173 species of marine fishes from both coasts Dr. Günther regards fifty-seven as identical. Mr. Gill would, however, separate some of these forms, but the general result would still remain the same, since certain species do not show even varietal differences. The Echinoderms of the two coasts have been examined and tabulated by the author* and gave very different results, for of eighty-two species found on the west coast none are identical with those of the Atlantic, unless two Holothurians which may be regarded as doubtful, though considered the same by Selenka. But at least fifty of the species are analogous, or correspond with similar Atlantic species.

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*Transactions of the Connecticut Academy, Vol. I, p. 339, 1867.

A careful comparative study of the corals and Polyps of the Atlantic, and extensive, and, for the shallow water forms, nearly complete collections from various localities on the Pacific coast, give quite unexpected results, since no species are found to be identical, while even the genera and families show remarkable contrasts. Thus the numerous genera and families of reef-building corals, so abundant on the Atlantic side, are wholly wanting on the Pacific, with the exception of Porites, which is represented by three or four small species. Massive Astræans, Mæandrina, Diploria, Manicina, Colpophyllia, Agaricia, Siderastræa, Oculina, Madrepora, Millepora, are wholly unknown in the Panama fauna. But Pocillipora, Montipora, and Pavonia, genera unknown on the Atlantic side, are represented, the last by two gigantic species. Among the Halcyonoid Polyps we find an equal contrast, for Eunicea, Plexaura, Plexaurella, Pterogorgia and many other very common Atlantic genera are unknown on the Pacific side, where they are replaced by numerous species of Psammogorgia, Litigorgia, and Eugorgia, which are eminently characteristic of that coast.

The genus Muricea is very common, and represented by seventeen species, while on the Atlantic side only four species are usually admitted, all of which are so different as scarcely to be regarded as analogous species. The genus Renilla is found on both coasts. Among the Actinians we find greater resemblances, but as yet no identical species.

From these facts we may legitimately conclude that no very extensive or deep connection, sufficient to alter the course of oceanic currents, can have existed since the coasts have been inhabited by the existing species, otherwise a greater admixture must have taken place. A narrow or shallow channel of communication would probably account for all identical species yet observed, but at what period it may have existed is still another question. The occurrence of certain Atlantic species in the Gulf of California and not at Panama (*Codakia tigerina, Paphrydia bullata*); the evidence of a uniform and long continued flow of the Gulf Stream, to be derived from the growth of the extensive coral reefs of the Bermudas, and the southern extension of Florida with its numerous ancient reefs of coral rock, one of which occurs even as far north as Tampa Bay, made up of existing species, show that the present coral faunæ are of immense antiquity, and also that the specific characters are wonderfully persistent. The peculiar relations between the two faunæ manifested by the numerous analogous but distinct species and genera are probably facts of a different order, and will require a different solution, for even if we adopt a developmental theory we shall doubtless be compelled to refer the period of separation to a period far more ancient than that at which the few identical species became separated, and to admit a far more extensive and prolonged connection between the two oceans.

Mr. G. L. VOSE read a paper entitled "Compression as an agent in Geological Metamorphism; with Illustrations of Distorted Pebbles in Conglomerates." The metamorphic regions are compressed regions. Compression produces heat, and changes not only the outward form but also the mineral nature of the rocks.

Prof. VERRILL, in his paper "On American Phyllopod Crustacea," gave an account of the habits, etc., of our species of Branchipus and Artemia. Of the latter he has obtained two new species, one from Mono Lake, California, and the other in numerous individuals from tubs of salt water on a railroad bridge near New Haven. These tubs, filled from the salt marsh, have become very salt by evaporation in the sun, thus giving the ordinary conditions for the development of this beautiful genus.

In her paper "On the Plumage of the Tern," Miss. G. A. LEWIS described the structure of the feather, illustrating her descriptions with several microscopic drawings.

Miss. LEWIS in her "Thoughts on the Structure of the Animal Kingdom," says, from the radiate to man there does not appear to be any direct line of connection from the higher members of one group to the lower members of the next; on the contrary the nearest allies are found near the origin of the groups. At such points there may be animals combining characters which afterward become specialized in several groups; as there may be some which rise above, whilst others sink below the grade common to the group. A succession of such points marking the origin of the invertebrate branches and the vertebrate classes, might be considered as a spiral around the *axial line* of the animal kingdom. From their respective points of origin the branches and classes proceed, each on its own road towards the perfection of its types, but *not* necessarily turned toward the branch or class above. It is probably the same line perceived by Haekel, and to which he refers as "commencing with Amphioxus, and proceeding through the Lampreys and the extinct allies of the Sharks to the Lepidosirens, thence through Proteus and its congeners to the Tritons and Salamanders, and thus to the Monotremata (Ornithorhyncus). The line passes through the Marsupials, the Lemurs, the old world Monkeys (Semnopithecus) and the Anthropoid Apes (Orang and Gorilla)."

The axial line was distinguished by the writer in the summer of 1867, and was alluded to in a little pamphlet published in the spring of 1868. She would begin with the lower radiates, pass through the earliest Crinoids, so reaching the origin of the Molluscous branch, ascend through the extinct Cephalopods, and pass the Articulates through the early worms and trilobites. She considered the three great invertebrate branches as lying horizontally at the base of the vertebrate axis. From thence she would pass through each vertebrate group, as it presented itself in the geologic period in which it took its rise, and thus reach man at whatever time he appeared in the Quaternary period. With the production of brain the animal rises from the horizontal towards the polar position of man. There are, however, some very curious exceptions to this general law. Along the axial line there is a tendency to return to the horizontal in some groups, with an extreme rise towards the polar in others. Between these extremes the group holds its proper level in proportion to the development of brain. Thus there comes to be one line of progression upwards towards man, and many outwards towards the periphery of the branching classes. In the vertebrate branch the birds hold an intermediate position, and, intelligently studied, throw a flood of light backward and forward over the animal world. Taking their rise between the reptile and the mammal they combine with the ornithic, both reptilian and mammalian characters, but the finest development of brain, with its accompanying delicacy of organization, exists at the extremities of the ornithic branch where the true bird type is found, purified, so to speak, of both reptilian and mammalian tendencies. Here we find the songsters and those birds which are most responsive to the influence of man. The axial line for the class of birds, like that of the animal kingdom, is marked by the carrying forward of a mingled stream. It is only near the terminal branches that the pure bird-like forms, the blossoms of the type are found.

The foot in Archæopteryx anticipates that found in the highest groups of birds, and peculiarities of structure drawn from the mammal are not wholly lost until the family of the parrots is passed. Here a rudiment of the diaphragm is found. In the animal kingdom the uncreated man, existing only in the conception of Deity, lifts the whole animal creation and holds it at a higher level.

Mr. Meehan also said, in regard to Cassia, that physiologically the leaf was considered the parent of the axillary bud,—and that "adventitious" buds was a term created to account for buds not axillary. The absorption of the bud by Cassia, and the existence of buds, one above another, in other plants, without connection with the petiole, and with the strongest *one the farthest removed from the petiole,* indicated that the leaf was *rather an enemy than an aid to bud development;* and that the classes of *axillary* and *adventitious* buds, had no physiological law to separate them.

Mr. Lewis H. Morgan gave a conjectural explanation of the Uses of the Embankments of the Mound Builders. Mr. Morgan considered them as the bases (built for defensive purposes) of the *pueblos* or villages of that race of men.

Mr. Porter C. Bliss then read a paper upon a New Classification of the South American Indians upon the basis of Philology. Mr. Bliss gave as one of the results of several years of travel and investigation among the aborigines of the Argentine Republic, Bolivia, Paraguay, Brazil, etc., the discovery that the number of stock languages within those regions has been exaggerated tenfold, and that there are, instead of one hundred and fifty or more as has been loosely stated by the Jesuits and other later writers, but twelve or thirteen stock languages in the Southern half of South America. Of all these he had collected vocabularies.

Mr. Bliss proceeded to point out on a large map of South America, the localities of each of the tribes mentioned, beginning with the Fuegians, and passing to the two races of Patagonians, the Araucarians of Chile, whom he identified with the Pehuenches, Huilliches and Aucas of the Pampas of Buenos Ayres, the Abipones, Tobas, Mocobis, Ocoles, Mataguayos and Machicuys of the Gran Chaco or region between Paraguay and Bolivia.

He then described the Guaranis and Payaguas of Paraguay, the Atacamus, Quichuas, Aymaras, Chiriguanos and Chiquuitians of Bolivia, and giving many facts respecting the character of their various languages. He adverted to the extensive area of the Guarani tongue, which extends substantially from the La Plata to the Oronoco, embracing a great portion of Brazil and most of the basin of the Amazon. He stated that he had found the Quichua language spoken in the centre of the Argentine Republic, in the province of Santiago del Estero, eight hundred miles from the nearest point in Bolivia where the same language is now spoken. Consequently Mr. Bliss considered this province to have been an outlying colony of the empire of the Incas.

The languages of the Indians of the Chaco are extremely meagre, and none of them exceeds about a thousand root-words.

Mr. Bliss stated that the principle of reduplication was largely concerned in the formation of the language of the Incas, and that he had collected in Bolivia more than three hundred geographical names formed in this way, as Mocomoco, Coro-coro, Quilli-quilli, and cited as a double reduplication the name of the famous lake Ti-ti-ca-ca. He stated that within two hundred years the Guarani language had undergone an almost complete change, so that instead of being now, as formerly, made up from monosyllabic radicals, it is quite as polysyllabic as most other Indian tongues.

Mr. E. S. Morse's paper "On the Early Stages of Brachiopods" was reported in the September number.

Prof. O. C. Marsh read a paper on the "Discovery of the Remains of the Horse among the Ancient Ruins of Central America," the title of which was inadvertently omitted in our list of papers presented to the Association.

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Valuable Library for Sale. — The Library of the late Dr. B. F. Shumard, of St. Louis, consisting principally of works on Geology and Palæontology, and believed to be very perfect so far as relates to North America, is offered for sale by M. L. Gray, administrator, No. 105 North 5th street, St. Louis. The Library (and also the collection of Fossils and Minerals, also for sale) can be inspected at No. 1302 Olive street, St. Louis.

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ANSWERS TO CORRESPONDENTS.

L. H. P. — The name of your "moss" is *Mastigobrium trilobatum* Nees., and the bit of "light wood" is stained by the *Peziza æruginosa*, a verdigris-green colored fungus not uncommon in woods. — J. L. R.